II. "On the Function of the Thyroid Gland." By Professor VICTOR HORSLEY, B.S., M.B., F.R.C.S. Communicated by Professor M. FOSTER, Sec. R.S. Received December 5, 1884.

(Preliminary Communication.)

Up till the year 1883 the function of the thyroid gland was unknown, and considered to be of slight importance, at least to the adult animal.

The theories concerning its function were—

(1.) The one propounded by Mr. Simon, "Phil. Trans.," 1844, &c., viz., that the thyroid body acted as a regulator of the circulation in the brain, and possibly manufactured some substance which was of primary importance for the nutrition of the central nervous system.

(2.) That it was a true gland, and secreted a mucinous albuminoid into the cavities of its acini, the secretion being reabsorbed by the lymphatics.

(3.) The thyroid gland has also from time to time been compared to the spleen as an hæmapoietic organ.

Although the intimate relationship of goitre to cretinism has been well known for many centuries, the fact that excision of the partially goitrous thyroid in comparatively healthy people was followed by severe symptoms of cretinism was first announced last year by Professor Kocher, of Berne, who collected 160 cases in which the operation had been partially or wholly performed. In the latter class of his own cases he found the patients, without exception, had become cretinous.

The symptoms described by Kocher were recognised by Dr. Semon* as similar to those of Myxœdema, and he advanced the theory that the conditions were allied. My experiments have proved the truth of this view, since I have produced the condition of myxœdema by simply excising (with strict antiseptic precautions and operating so as to avoid all nerve trunks) the thyroid gland in the monkey.

Schiff in Geneva, Wagner in Vienna, and Sanquineco and Canalis in Turin, have made similar experiments on dogs, but they do not appear to have found the myxœdematous condition; simply, it appears, because, for one reason or another, their animals did not survive the operation long enough to develop the pathological changes.

However, they show that in the dog careful ablation of the thyroid gland is followed by severe nervous symptoms, which commence a few hours, or days, after the operation, by fibrillar contractions and

* "Brit. Med. Jour.," Nov. 30, 1883.

tremors in all the muscles of the body. These tremors soon become clonic spasms, and ultimately paroxysms of true tetanus, as a result of which the animal dies a few days after the operation.

It is clear then that in dogs the thyroid gland has an intimate connexion with the central nervous system.

In the monkey, excision of the thyroid, just as in the dog, may be followed immediately by fibrillar contractions of the muscles of the extremities, but, as a rule, the animal remains perfectly well for five days.

The tremor at its first appearance is uniform, and has a wave rate of 8–10 per second.

In forty-eight hours, as a rule, it becomes paroxysmal, *i.e.*, exhibits recurring exaggerations, the paroxysms being of variable duration and interval, but giving a new character to the tracing, owing to the powerful movements of the limbs, &c.

The uniform tremor persisting between the paroxysms now has, as a rule, a wave rate of 16 to 20 per second.

These symptoms persist, as a rule, about twenty days; they then decline, the paroxysms disappearing slowly, but ceasing before the constant tremor.

During the whole of this time there is rigidity and paresis* of the muscles affected.

Moreover, the symptoms of the disease termed Myxœdema by Dr. Ord, and ordinary cretinism are gradually developed.

For—

The animal becomes gradually more and more imbecile and apathetic, sitting, as it does, huddled up and taking no notice of anything, in strong contrast to its customary vivacious state.

It exhibits swellings of the skin of the face, abdomen, &c., due to infiltration of the tissues by mucin. (This change, visible to the naked eye, has been chemically established by my friend Dr. Halliburton, B.Sc., whose results are published in accompanying table.)

The salivary glands become enormously hypertrophied, and the parotid gland, which normally secretes a watery, serous fluid, now takes up a muciparous function,† and produces quantities of mucin.

This increase of function is interesting, as probably offering a clue for further investigation into the physiology of secretion.

The blood is profoundly changed: there is a decrease of red corpuscles, and a primary increase of the leucocytes, followed by a decrease, oligæmia thus resulting. Moreover, it contains mucin in proportion to the duration of life after the operation, and the serum albumin is diminished.

* Sometimes almost total paralysis of the extensor muscles.

† Microscopic investigation shows the cells of the parotid to be swollen by mucinogen (?) and rapidly disintegrating.—14th December, 1884.

The temperature, slightly raised by the operation, becomes variable, and then after about twenty-five days, gradually sinks far below the normal, and the animal dies comatose.

It is proved by examination of the parts that in the operation the thyroid gland only was removed, the surrounding structures being uninjured; consequently the thyroid gland may now be looked upon as being of extreme importance in the animal economy, and especially in relation to three points—

(1.) The nutrition of the nervous system.

(2.) The existence of mucin in the body.

(3.) The composition of the blood.

The practical surgical question as to whether the cretinous symptoms following thyroidectomy are due to—

(1.) Chronic asphyxia, as believed by Kocher;

(2.) Injury of the sympathetic and other nerve trunks;

(3.) Arrest of function of the thyroid gland;

is almost settled in favour of the third view, and with it also the pathology of Myxœdema.

3rd December, 1884.

Analysis of Tissues (Monkey) Healthy and after Thyroidectomy. By Dr. W. D. Halliburton, B.Sc.

Amount of Mucin per 1000 parts of the tissue.

Normal.	Skin and subcutaneous tissue.	Tendon.	Muscle.	Parotid gland.	Submaxillary gland.	Blood.
No. 1*a*. Healthy monkey (killed) .	·89	·39	0	..	..	0
No. 9. „ „ „ .	·9	·5	0	0	·01	0
Abnormal, after Thyroidectomy.						
No. 1 lived 55 days.....	3·12	2·55	0	·72	6·0	·35
„ 3 „ 32 „	..	..	..	..	..	trace
„ 5 „ 49 „	2·3	2·4	trace	1·7	3·3	·08
„ 10 „ 7 „	..	..	0	..	..	merest trace

The tissues were minced finely, and kept under alcohol for one week; the mucin then was dissolved out by baryta-water and reprecipitated by acetic acid. The precipitate from known weights of tissue was thoroughly washed, and then dried at 100° C., to give the quantitative result. The chemical research was carried out in the Physiological Laboratory of University College, London.